CITY OF SCOTTSDALE

Water Study

WATER & WASTEWATER
BASIS OF DESIGN REPORT
FOR
SENIOR LIVING AT MCDOWELL MOUNTAIN RANCH

9909 E. MCDOWELL MOUNTAIN RANCH ROAD
SCOTTSDALE, ARIZONA 85260

Prepared for:

RYAN A+E, INC.
3900 E. Camelback Road Ste 100
Phoenix, AZ 85018

Prepared by:

LANDCOR CONSULTING
6859 E. Rembrandt Ave. #124
Mesa, Arizona 85212
(480) 223-8573

Registered Professional Engineer (Civil)
CERTIFICATE NO. 33981
WADE E. COOKE
Date Signed 6/28/19
ARIZONA, U.S.A.

May 13, 2019
Revised June 28, 2019
Job # 1617

FINAL Basis of Design Report
☑ **APPROVED**
☐ **APPROVED AS NOTED**
☐ **REVISE AND RESUBMIT**

CITY OF SCOTTSDALE
SCOTTSDALE WATER
9379 E San Salvador Dr.
Scottsdale, AZ 85258

Disclaimer: If approved; the approval is granted under the condition that the final construction documents submitted for city review will match the information herein. Any subsequent changes in the water or sewer design that materially impact design criteria or standards will require re-analysis, re-submittal, and approval of a revised basis of design report prior to the plan review submission.; this approval is not a guarantee of construction document acceptance.
For questions or clarifications contact the Water Resources Planning and Engineering Department at 480-312-5685.

BY rsacks **DATE** 7/8/2019

8-ZN-2019
7/01/2019

WATER & WASTEWATER BASIS OF DESIGN REPORT

FOR

SENIOR LIVING AT MCDOWELL MOUNTAIN RANCH

TABLE OF CONTENTS

I. PROJECT DESCRIPTION

This Project is a proposed 161 unit senior care facility on a vacant 5 acre parcel located east of 98th Street on the south side of McDowell Mountain Ranch Road (see Figure 1). Site development consists of a single building with three floors with separate entrances and drop-off areas for independent/assisted and memory care. A large triangular area at the northeast corner of the property contains a remnant of the little-known old Rio Verde Canal (berm) which has been reclaimed by dense native vegetation and will be left untouched.

The site is a portion of the southwest quarter of Section 5, Township 3 North, Range 5 East of the Gila and Salt River Base and Meridian. The site is bound by McDowell Mountain Ranch Road to the north and undeveloped properties on the East, West and South sides.

The purpose of this report is to present a drainage design that is in compliance with City of Scottsdale's *Design Standards & Policies Manual* (DS&PM) and is compatible with the existing development.

II. EXISTING CONDITIONS

Water Distribution System

There is an existing City of Scottsdale 12-inch DIP public water main located in McDowell Mountain Ranch Road. See the *Preliminary Site Utility Plan* (Appendix A) for locations of existing water lines.

Sanitary Sewer System

There is an existing 8-inch DIP sewer main in McDowell Mountain Ranch Road which flows to the west. There is also a 24-inch PVC sewer main which runs through the Bureau of Reclamation (BOR) parcel on the west side of the site. This main combines with the 8-inch main in McDowell Mountain Ranch Road near the northwest corner of the site. After the two mains combine, they continue to the west in McDowell Mountain Ranch Road in a 24-inch PVC main. See the *Preliminary Site Utility Plan* (Appendix A) for locations of existing sanitary sewer facilities.

III. BASIS OF DESIGN

Water Distribution System

A new 8-inch public water line extension into the site is proposed and will connect to the existing 8-inch main McDowell Mountain Ranch Road. The proposed water line and appurtenances will be contained within a water line easement in accordance with City of Scottsdale requirements. The building will have separate domestic water and fire services. Three fire hydrants are proposed. See the *Preliminary Site Utility Plan* (Appendix A) for location and sizes of proposed water lines serving the Project.

Domestic Water

For the purposes of this Rezoning review, the average daily water demand for this project was calculated to be 71,854 GPD based on *DS&PM Chapter 6, Figure 6-1.2* (Appendix B). Detailed calculations based on fixture type/count will be provided during the final design phase of this project.

Fire

Fire flow requirements for the project are as follows:

Building Area =	164,112 sq. ft.
Construction Type =	V-B
Fire Flow Required =	8,000 gpm (from IFC Table B105.1)
Min. Fire Flow Required =	2,000 gpm (75% reduction for fire sprinklers)

A fire hydrant flow test was conducted in accordance with DS&PM Chapter 6 and is included in Appendix C. Based on the certified hydrant flow test, the flow rate at a residual pressure of 30 psi is 4,783 gpm. This residual flow rate is greater the required fire flow and therefore meets the requirements for the proposed building in accordance with City of Scottsdale's DS&PM and International Fire Code (IFC) requirements. If required, a water distribution model and detailed analysis will be provided with final design.

Sewer

Wastewater discharge from this site will be collect in a new 6-inch private sewer line and discharged to the existing 8-inch sewer main in McDowell Mountain Ranch Road in accordance with City of Scottsdale minimum requirements for commercial developments. Design flows were calculated using *DS&PM Chapter 7, Figure 7-1.2* (see Appendix B). The 6" sewer service is adequately sized to accommodate Peak Day flow from this Project as demonstrated from the calculations.

IV. CONCLUSIONS

- Water and sewer infrastructure will be designed in accordance with the City of Scottsdale's Design Standards and Policies Manual (DS&PM), M.A.G. and City of Scottsdale supplemental details and specifications.
- A new 8" public water line will be installed from McDowell Mountain Ranch Road.
- The domestic water service and meter will be adequately sized to meet the water demand for the proposed building.
- The existing and proposed water distribution system has adequate capacity to meet Project fire flow demand in accordance with the DS&PM and IFC requirements.

- The proposed 6-inch sewer line is adequately sized to meet the calculated wastewater demand.

- All construction will be in compliance with applicable environmental laws and regulations.

APPENDIX A

FIGURES

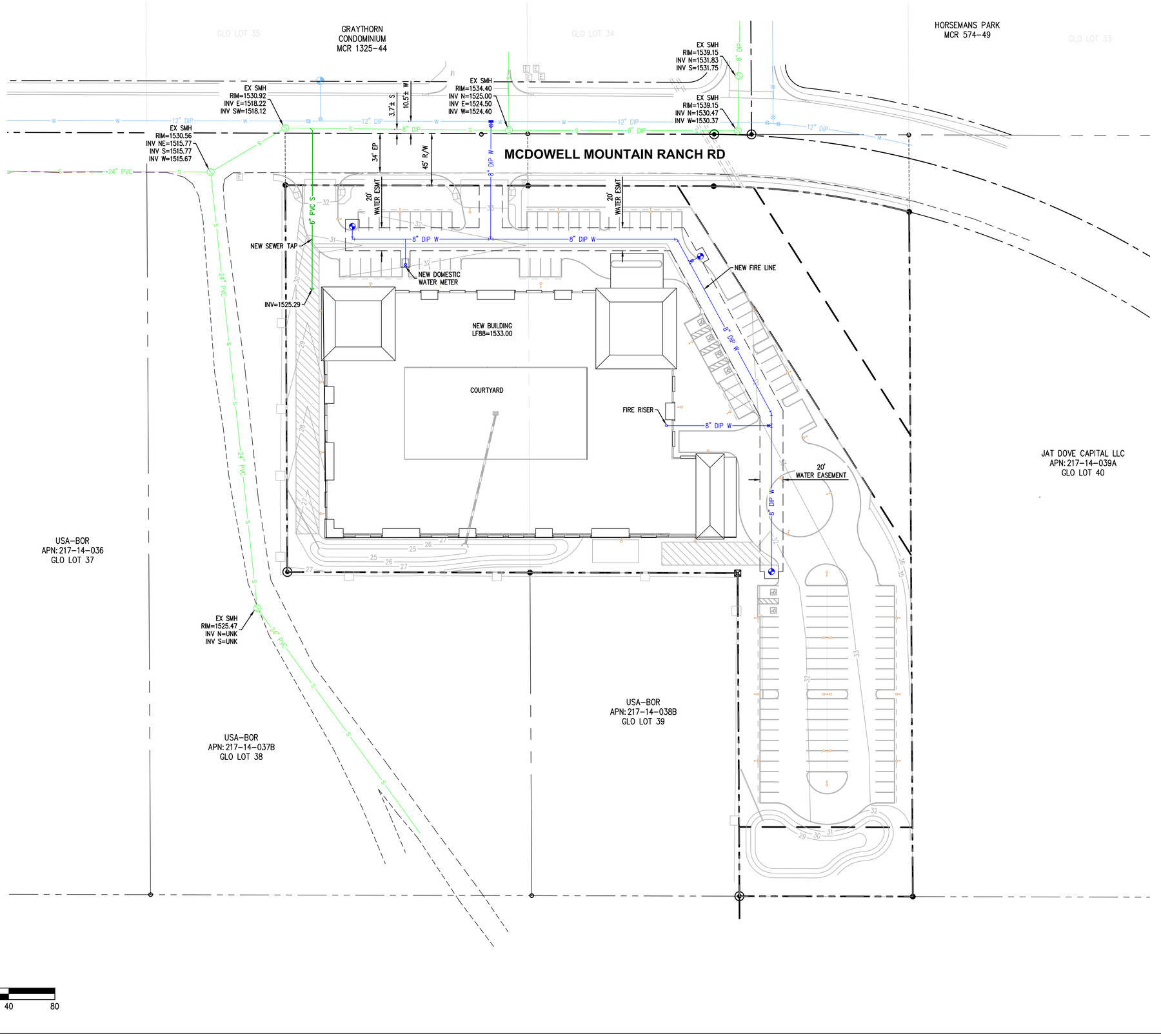
Map

8-ZN-2019

FIGURE 1
SITE LOCATION MAP

7/01/2019

PRELIMINARY SITE UTILITIES



PRELIMINARY NOT FOR CONSTRUCTION

Registered Professional Engineer (Civil) CERTIFICATE NO. 33981 WADE E. COOKE Date Signed 6/28/19 ARIZONA, U.S.A.

RYAN

RYAN A+E, INC.
3900 E. Camelback Road, Ste 100
Phoenix, AZ 85018
602-322-6100 tel
602-322-6300 fax

WWW.RYANCOMPANIES.COM

OWNER

CONSULTANTS

LANDCOR CONSULTING
6859 E. Rembrandt Ave. #124
Mesa, Arizona 85212
Ph: (480) 223-8573
landcorconsulting.com

PROJECT INFORMATION

Senior Living at McDowell Mountain Ranch
9909 East McDowell Mountain Ranch Road, Scottsdale, AZ

I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Registered Architect under the laws of the State of Arizona

Wade E. Cooke, P.E.

REGISTRATION NO.	DATE
33981	6/28/19

DRAWN BY	CHECKED BY
JDM	WEC
JOB NO.	DATE
1617	6/28/19

ISSUE RECORD

ISSUE #	DATE	DESCRIPTION

99-2019 ZONING

ZONING PACKAGE

05.10.19

PRELIMINARY SITE UTILITIES

C3

8-ZN-2019
7/01/2019

36-51

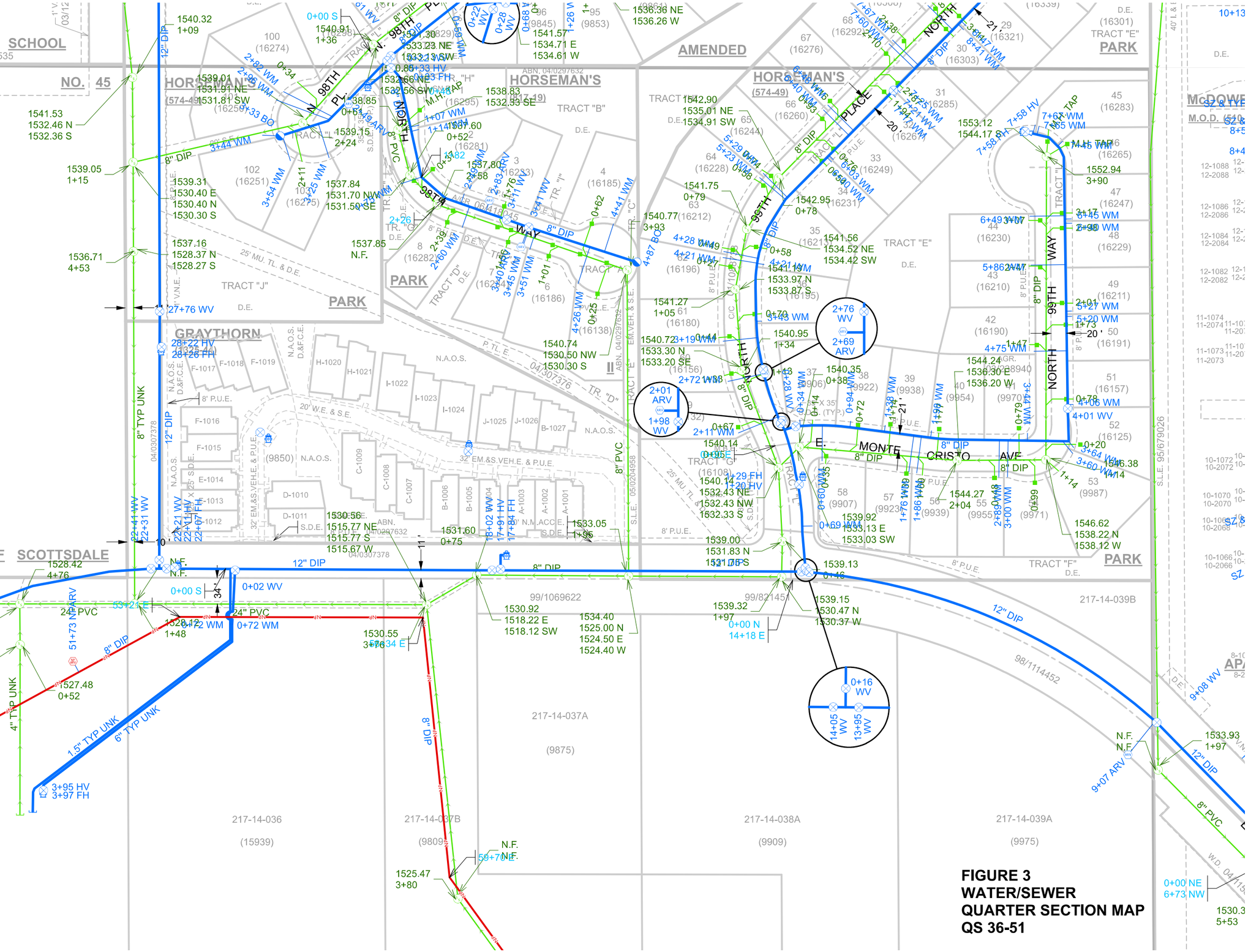


FIGURE 3
WATER/SEWER
QUARTER SECTION MAP
QS 36-51

GENERAL NOTES:

- THIS IS A COMPUTER GENERATED DRAWING, FOR ANY REVISIONS PLEASE CONTACT THE CITY OF SCOTTSDALE GIS DEPARTMENT AT (480) 312-7792.
- THE SECTION LINE BEARING AND DISTANCES ARE BASED ON THE CITY OF SCOTTSDALE GPS SURVEY OF SEPTEMBER, 1991. BEARINGS ARE NAD 83 GRID AND DISTANCES ARE FLATTENED TO GROUND. WHERE NO CORNER WAS FOUND THE DIMENSIONS ARE GIVEN TO CALCULATED SECTION CORNERS AND ARE NOTED AS 'CALCULATED' ON THE MAP.

LEGEND:

- Water Valve
- Non-potable Water Valve
- Fire Hydrant
- Water Blowoff
- Water Main Reducer
- Water Sample Station
- Water Air Release Valve
- Non-potable Water Air Release Valve
- Water Pressure Reducing Valve
- Water Vault
- Water Manhole
- Non-Potable Water Manhole
- Water Pump
- Water Main
- Non-Potable Water Main
- Fire Line
- Water Service
- Non-Scottsdale Water Main
- Sewer Manhole
- Sewer Cleanout
- Sewer Lift Station
- Sewer Treatment Plant
- Sewer Main - Gravity
- Sewer Main - Force
- Non-Scottsdale Sewer Main
- Sewer Service

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APPENDIX B

WATER & SEWER CALCULATIONS

LANDCOR CONSULTING
6859 E. Rembrandt Ave. #124
Mesa, Arizona 85212
(480) 223-8573

Senior Living at McDowell Mountain Ranch
Water & Sewer Basis of Design Report

Development Data:

Development:	Senior Living at McDowell Mountain Ranch Report Prepared by Landcor Consulting, PC (480-223-8573)
Location:	9909 E McDowell Mountain Ranh Road Scottsdale, AZ 85260
Existing Zoning:	R1-35 ESL
Proposed Zoning:	C-O PCD ESL
Land Use:	Residential Health Care Facility
Population:	See below

Water Impact:

Water Usage	Land Use	Average Day Water Demand per Unit (GPD)	Unit	Quantity	Design Flow (GPD)
Senior Living Facility: Includes independent living, assisted living, and memory care	Hotel *	446.3	DU	161	71,854

Average Day Demand = **71,854** GPD

Sewer Impact:

Wastewater Source	Land Use	Design Flow per Unit (GPD)	Unit	Quantity	Design Flow (GPD)
Senior Living Facility: Includes independent living, assisted living, and memory care	Hotel *	380	DU	161	61,180

Site Design Flow = **61,180** GPD

Peak Day = 4.5 x Design Flow = **275,310** GPD
= **191.2** GPM

Therefore, Q6" (232 GPM) > Q (Peak Day)

* Land Use for this development was approximated by the Resort Hotel (includes site amenities) land use in the City of Scottsdale's DS&PM Figure 6-1.2 and Figure 7-1.2.

Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Nov 7 2018

6-in Sewer Service

Circular

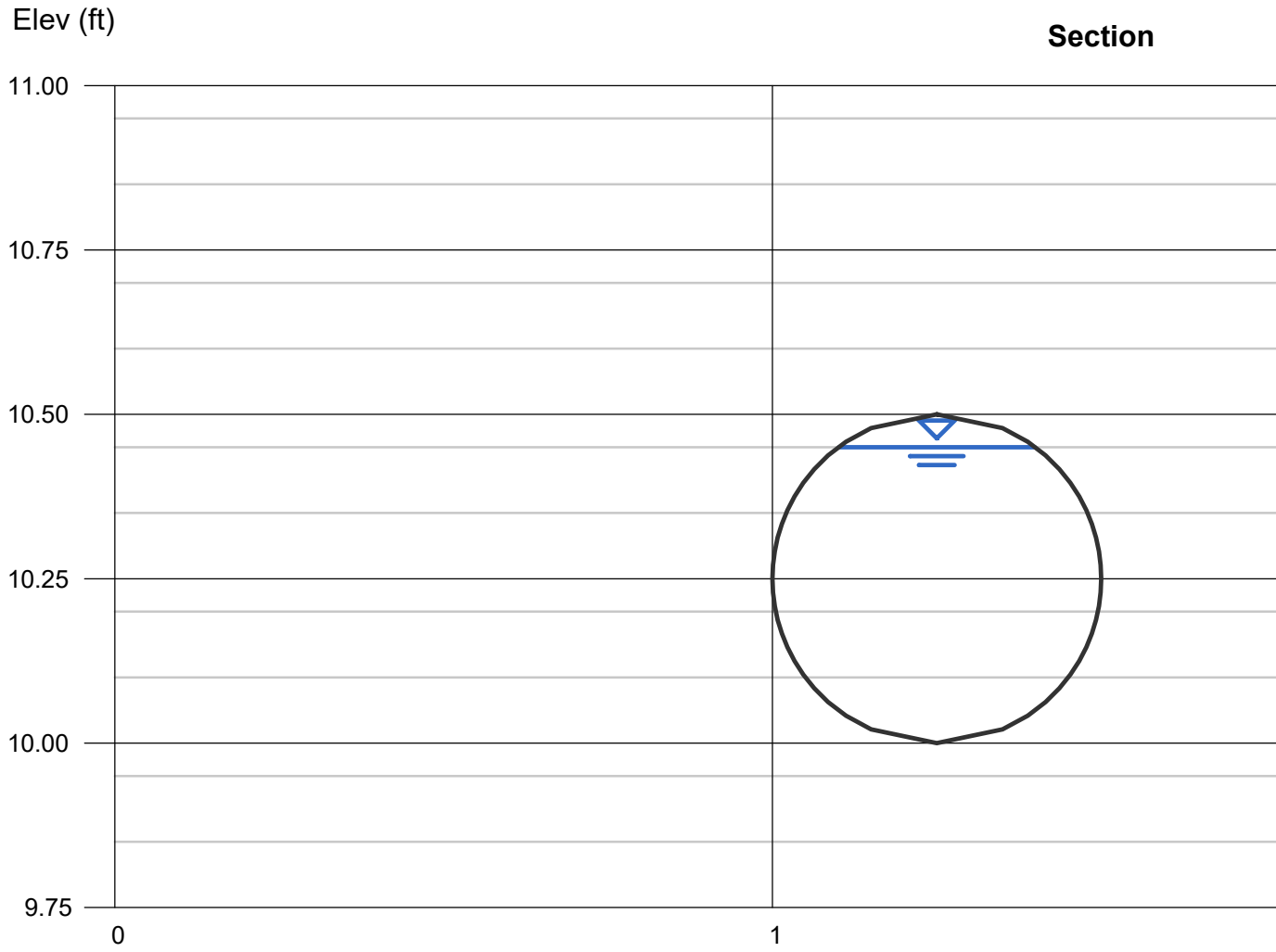
Diameter (ft)	= 0.50
Invert Elev (ft)	= 10.00
Slope (%)	= 1.00
N-Value	= 0.015

Calculations

Compute by:	Q vs Depth
No. Increments	= 10

Highlighted

Depth (ft)	= 0.45
Q (cfs)	= 0.518
Area (sqft)	= 0.19
Velocity (ft/s)	= 2.78
Wetted Perim (ft)	= 1.25
Crit Depth, Yc (ft)	= 0.37
Top Width (ft)	= 0.30
EGL (ft)	= 0.57



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d. Pipe flow velocity in feet per second (fps)
e. Each pipe segment's head loss rate (ft. /1,000ft or psi/ft.)
f. PRVs: Upstream and downstream pressures (psi or HGL elevation)
g. Tanks: Inflow and outflow (gpm)
h. Shows all units for the values presented or provide a legend on the diagram page that indicates the units used

AVERAGE DAY WATER DEMANDS [1]							
IN GALLONS PER DAY (GPD) [2]				IN GALLONS PER MINUTE (GPM) [2][3]			
Land Use	Inside Use	Outside Use	Total Use	Inside Use	Outside Use	Total Use	Units
Residential Demand per Dwelling Unit							
< 2 dwelling unit per acre (DU/ac)	208.9	276.7	485.6	0.30	0.39	0.69	per unit
2 – 2.9 DU/ac	193.7	276.7	470.4	0.27	0.39	0.66	per unit
3 – 7.9 DU/ac	175.9	72.3	248.2	0.25	0.11	0.36	per unit
8 – 11.9 DU/ac	155.3	72.3	227.6	0.22	0.11	0.33	per unit
12 – 22 DU/ac	155.3	72.3	227.6	0.22	0.11	0.33	per unit
High Density Condominium (condo)	155.3	30	185.3	0.22	0.05	0.27	per unit
Resort Hotel (includes site amenities)	401.7	44.6	446.3	0.56	0.07	0.63	per room
Service and Employment							
Restaurant	1.2	0.1	1.3	1.67E-03	1.39E-04	1.81E-03	per square foot (sq.ft.)
Commercial/ Retail	0.7	0.1	0.8	9.73E-04	1.39E-04	1.11E-03	per sq.ft.
Commercial High Rise	0.5	0.1	0.6	6.95E-04	1.39E-04	8.34E-04	per sq.ft.

AVERAGE DAY WATER DEMANDS [1]							
IN GALLONS PER DAY (GPD) [2]				IN GALLONS PER MINUTE (GPM) [2][3]			
Office	0.5	0.1	0.6	6.95E-04	1.39E-04	8.34E-04	per sq.ft.
Institutional	670	670	1340	0.94	0.94	1.88	per acre
Industrial	873	154	1027	1.22	0.22	1.44	per acre
Research and Development	1092	192	1284	1.52	0.27	1.79	per acre
Special Use Areas							
Natural Area Open Space	0	0	0	0.0	0.0	0.0	per acre
Developed Open Space – Parks	0	1786	1786	0.0	2.49	2.49	per acre
Developed Open Space – Golf Course	0	4285	4285	0.0	5.96	5.96	per acre

Notes:
(1) These values shall not be used directly for service line or water meter sizing.
(2) Gallon per day values are provided for reference only. The instantaneous gallon per minute flow rates presented are intended for use in the required hydraulic modeling scenarios. The gpm values assume a 12-hour active water use period per 24-hour day. In large or specialty developments or master plans the hydraulic analysis criteria and parameters should be discussed with the Water Resources Department. Seasonal peaking should also be considered. Upon review, the Water Resources Department reserves the right to designate flows to be used in hydraulic modeling scenarios that may be different from those presented here.
(3) The hydraulic modeling peaking factors used in select modeling scenarios are to be applied to the gpm values shown here. Max day and peak hour peaking factors can be found in Section 6-1.404.

FIGURE 6-1.2 AVERAGE DAY WATER DEMANDS

calculations to the Water Resources Department for permission to use extra-strength pipe, special bedding specifications, or alternative construction methods. The Water Resources Department must accept the request in writing prior to Plan Review's approval of the final plans.

Ensure that all types of pipe material used in design have established ASTM, ANSI, AWWA or NSF standards of manufacture or seals of approval and are designated for use with wastewater.

SYSTEM LAYOUT 7-1.402

Generally, SS lines constructed along a street grid should be aligned parallel to, and south or west of the street centerline. Lines should not cross the street centerline except in cases where curvilinear roadway alignments are encountered.

Public SS lines within commercial, industrial or multi-family developments must be located within drive aisles a minimum of 6 feet from any structure. Public SS lines will be located within tracts and/or sewer line easements. No private utilities are allowed longitudinally within a sewer line easement.

Curvilinear SS lines are not allowed. Developments with numerous curved streets should be discussed with the Water Resources Department to decide whether the city will consider a design report with water and sewer layouts in accordance with the following criteria:

A. Water and SS lines will be placed under the paved section of the roadway within the area, from back-of-curb to back-of-curb.
B. SS lines must maintain a minimum of 6-feet horizontal clearance to dry utilities per COS Standard Detail No. 2401.
C. SS manholes are to be located at the approximate center of the drive lane.
D. The water line and SS line shall run parallel to each other with 6 feet of separation between the pipe walls. Lines may cross the street centerline.
E. Deflections in the SS line through manholes shall be designed to nominal fitting angles within standard tolerances and will occur at the same locations where the water line is deflected. Refer to Section 6-1.402 for related water system criteria.

DESIGN FLOWS 7-1.403

A. **Residential**

SS lines 8 to 12 inches in diameter will be designed using 100 gallons per capita per day (gpcpd) and a peaking factor of 4.

SS lines larger than 12 inches in diameter will be designed using 105 gpcpd and a peaking factor developed from "Harmon's Formula":

$Q_{max} = Q_{avg} \times [1 + (14 / (4 + P1/2))]$

P = Population / 1,000

Residential densities are to assume 2.5 persons per dwelling unit. Multifamily densities exceeding 22 dwelling units per acre can assume 1.7 to 2.2 persons per unit.

B. **Commercial and Industrial**

Wastewater flows for uses other than those listed below shall be based upon known regional or accepted engineering reference sources approved by the Water Resources Department.

LAND USE	DEMAND (gpd)	DESIGN PEAKING FACTOR
Commercial/Retail	0.5 per sq. ft.	3
Office	0.4 per sq. ft.	3
Restaurant	1.2 per sq. ft.	6
High Density Condominium (Condo)	140 per unit	4.5
Resort Hotel (includes site amenities)	380 per room.	4.5
School: without cafeteria	30 per student	6
School: with cafeteria	50 per student	6
Cultural	0.1 per sq. ft.	3
Clubhouse for Subdivision Golf Course	100 per patron x 2 patrons per du per day	4.5
Fitness Center/ Spa/ Health club	0.8 per sq. ft.	3.5

FIGURE 7-1.2 AVERAGE DAY SEWER DEMAND IN GALLONS PER DAY & PEAKING FACTORS BY LAND USE

HYDRAULIC DESIGN 7-1.404

No public SS lines will be less than 8 inches in diameter unless permission is received in writing from the Water Resources Department.

SS lines shall be designed and constructed to give mean full flow velocities equal to or greater than 2.5 fps, based upon Manning's Formula, using an "n" value of 0.013.

To prevent abrasion and erosion of the pipe material, the maximum velocity will be limited to 10 fps at estimated peak flow. Where velocities exceed this maximum figure, submit a hydraulic analysis along with construction recommendations to the Water Resources Department for consideration. In no case will velocities greater than 15 fps be allowed.

Actual velocities shall be analyzed for minimum, average day and peak day design flow conditions for each reach of pipe.

The SS system shall be designed to achieve uniform flow velocities through consistent slopes. Abrupt changes in slope shall be evaluated for hydraulic jump.

The depth to diameter ratio (d/D) for gravity SS pipes 12 inches in diameter and less shall not exceed 0.65 in the ultimate peak flow condition. This d/D ratio includes an allowance for system infiltration and inflow.

The d/D for gravity drains greater than 12 inches diameter shall not exceed 0.70 for the ultimate peak flow condition. This d/D includes an allowance for system infiltration and inflow.

Measures to mitigate hydrogen sulfide shall be analyzed at manhole drops, abrupt changes in pipe slope or direction and at changes in pipe diameter.

MANHOLES AND CLEAN OUTS 7-1.405

Manholes in city streets shall be located near the center of the inside traffic lane, rather than on or near the line separating traffic lanes. Manholes shall not be in bike trails, equestrian trails, sidewalks, crosswalks or wash crossings. Manholes are required at all

APPENDIX C

HYDRANT FLOW TEST REPORT

& FIRE FLOW INFORMATION

Arizona Flow Testing LLC

HYDRANT FLOW TEST REPORT

Project Name:	MMR Commons
Project Address:	McDowell Mtn Ranch & Thompson Pk., Scottsdale, Arizona, 85260
Client Project No.:	Not Provided
Arizona Flow Testing Project No.:	18385
Flow Test Permit No.:	C56606
Date and time flow test conducted:	November 7, 2018 at 7:30 AM
Data is current and reliable until:	May 7, 2019
Conducted by:	Floyd Vaughan – Arizona Flow Testing, LLC (480-250-8154)
Coordinated by:	Jared Berry – City of Scottsdale-Inspector (602-541-4942)

Raw Test Data

Static Pressure: **88.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **80.0 PSI**
(Measured in pounds per square inch)

Pitot Pressure: **27.0 PSI**
(Measured in pounds per square inch)

Diffuser Orifice Diameter: One 4-inch Hose Monster
(Measured in inches)

Coefficient of Diffuser: 0.7875

Flowing GPM: **1,954 GPM**
(Measured in gallons per minute)

GPM @ 30 PSI: **5,694 GPM**

Data with 16 PSI Safety Factor

Static Pressure: **72.0 PSI**
(Measured in pounds per square inch)

Residual Pressure: **64.0 PSI**
(Measured in pounds per square inch)

Scottsdale requires a maximum Static Pressure of 72 PSI for AFES Design.

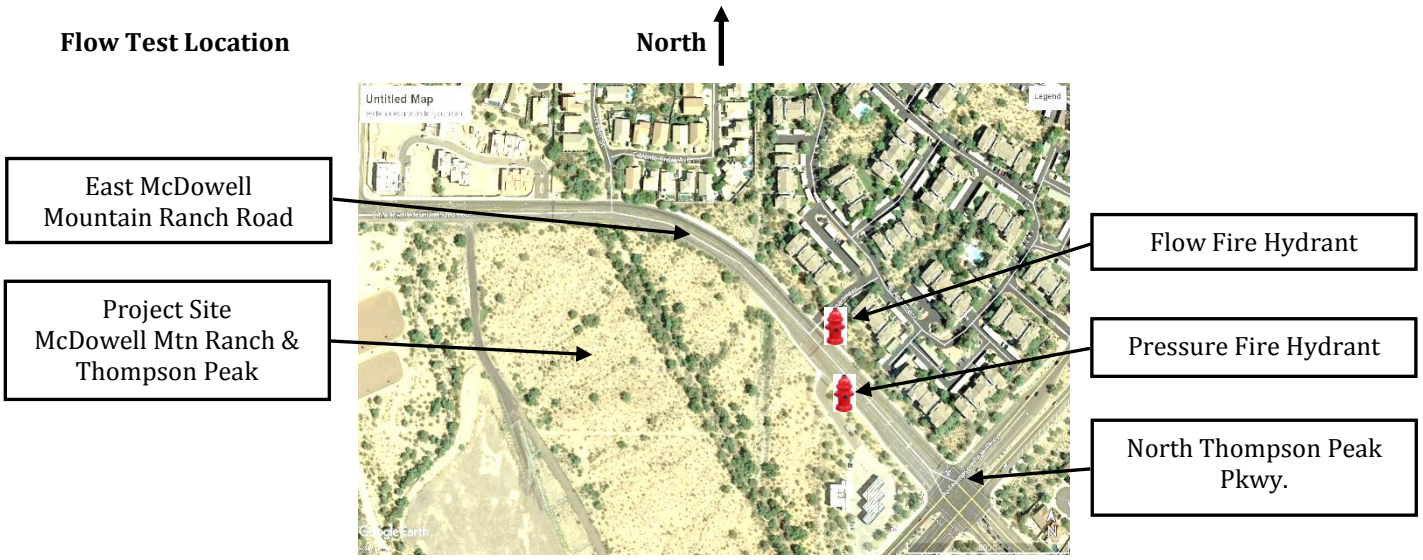
Distance between hydrants: Approx. 240 Feet

Main size: Not Provided

Flowing GPM: **1,954 GPM**

GPM @ 30 PSI**:** **4,783 GPM**

Flow Test Location **North**



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APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101
GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102
DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103
MODIFICATIONS

B103.1 Decreases. The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code.*

SECTION B104
FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings which are separated by *fire walls* without openings, constructed in accordance with the *International Building Code,* are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105
FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration requirements for one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings*, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.2 and B105.1(2).

TABLE B105.1(1)
REQUIRED FIRE-FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
0-3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0-3,600	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	500	$^1/_2$
3,601 and greater	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	$^1/_2$ value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute)[b]	FLOW DURATION (hours)
Type IA and IB[a]	Type IIA and IIIA[a]	Type IV and V-A[a]	Type IIB and IIIB[a]	Type V-B[a]		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.
a. Types of construction are based on the *International Building Code*.
b. Measured at 20 psi residual pressure.

TABLE B105.2
REQUIRED FIRE-FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE-FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *International Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *International Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.
a. The reduced fire-flow shall be not less than 1,000 gallons per minute.
b. The reduced fire-flow shall be not less than 1,500 gallons per minute.

B105.3 Water supply for buildings equipped with an automatic sprinkler system. For buildings equipped with an approved *automatic sprinkler system*, the water supply shall be capable of providing the greater of:

1. The *automatic sprinkler system* demand, including hose stream allowance.
2. The required fire-flow.

SECTION B106
REFERENCED STANDARDS

ICC	IBC—15	International Building Code	B104.2,
ICC	IFC—15	International Fire Code	Tables B105.1(1) and B105.2
ICC	IWUIC—15	International Wildland-Urban Interface Code	B103.3
ICC	IRC—15	International Residential Code	Table B105.1(1)
NFPA	1142—12	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3